Chen, W. et al. (Eds.) (2016). Proceedings of the 24th International Conference on Computers in Education. India: Asia-Pacific Society for Computers in Education

Ontology of Culture: A Procedural Approach for Cultural Adaptation in ITSs

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Abstract: We believe that Culture can affect teaching and learning, primarily due to the existence of cultural variables in educational practices. The multiplication of opportunities to learn and teach abroad and the growing desire on the part of universities to attract an international clientele increase the need for cultural adaptation. However, as pointed out by Rogers, Graham and Mayes (2007), teachers are not always aware of these cultural variables. If these cultural variables were made explicit, it would be easier for instructional designers, teachers and learners to adapt to the different cultures. In this article, we present our understanding of the notion of Culture and an upper ontology of Culture modeled according to a procedural approach. We believe that such an approach allows us to make explicit the functionalities of Culture so that we are able to understand how it can influence not only our daily lives, but more particularly teaching and learning. It opens the door to concrete and practical solutions for cultural adaptation in ITSs.

Keywords: Ontology, Culture, Cultural Variables, Instructional Design, Cultural Adaptation

1. Introduction

We face new challenges with the internationalization of education. The multiplication of opportunities to learn and teach abroad and the growing desire on the part of universities to attract an international clientele increase the need for cultural adaptation. In fact, we have noticed the growing popularity of distance learning and the appearance (and utilization) of Massive Open Online Courses (MOOCs). Many professors are now required to teach learners from a different culture than their own, and learners do not hesitate to study abroad, often by staying in their homes. Clearly, these realities give rise to new concerns in curriculum planning. The need for flexibility seems obvious. Instructional designers, teachers and learners need to adapt to these new cultural meetings.

We believe that Culture can affect teaching and learning, primarily due to the existence of cultural variables in educational practices. For example, expectations of the learner or of the teacher might be quite different from one Culture to another. An unexpected behavior could lead one to estimate the other unfairly as incompetent, with all the consequences that this entails. Vigorous competition among learners in one Culture can make it difficult to use collaborative learning activities that are considered normal in another.

However, as pointed out by Rogers, Graham and Mayes (2007), teachers are not always aware of cultural variables in educational practices and instructional designers are not immune to the influence of their own cultural blinders. We believe that if these cultural variables are made explicit (since they are often implicit), it will be easier for instructional designers, teachers and learners to adapt to the different cultures.

In this article, we present our understanding of the notion of Culture and an upper ontology of Culture modeled according to a procedural approach. We believe that such an approach allows us to make explicit the functionalities of Culture so that we are able to understand how it can influence not only our daily lives, but more particularly teaching and learning. It opens the door to concrete and practical solutions for cultural adaptation in ITSs.

2. Understanding Culture

2.1 Definition of Culture

Since Tylor (1871) first defined the notion of Culture, it has been redefined in different ways and in different domains. Savard (2014) has presented a selection of important definitions. As explained by Alber (2002), various criticisms have been made to the existing definitions: one was too evolutionist and did not allow for the consideration of different cultures on the same footing as regards equality; many of them did not represent the evolving nature of Culture in time, i.e., its dynamism. The main challenge always relates to the fact that we are attempting to understand the diversity of cultures from the universality that links human beings.

For this research, we have slightly adapted the definition proposed by Savard, Bourdeau and Paquette (2013). We consider that this definition takes into account the evolving nature of Culture, allows for the consideration of different cultures on the same footing as regards equality and considers the explicit and implicit components of Culture. Thus, we consider Culture as being:

> *an evolving (in both time and space) cognitive structure composed of such schemes that influence the behavior of each of the members of a given group, the manner in which the members of the group interpret the behavior of other persons and groups, and the processes of interpretation and representation that allow them to interact with their environment.*

By schemes we mean *abstract mental representations by which we anticipate the future, or by which we prepare action, either intellectual or physical.* Most of the time, these schemes refer to tacit knowledge that are collectively formed and reproduced. Naturally, they can be reproduced with more or less intensity from one individual to another. One may be, consciously or not, more or less influenced by them. As illustrated in Figures 1 and 2, these schemes consist of interpretation schemes and manifestation schemes. The former include in particular dimensions of basic values and assumptions. They are not directly observable. The latter are abstract mental representations of manifestations (which we can observe) and correspond to artifact schemes and behavior schemes. This definition serves as a basis for the Conceptual Model of Culture (Figure1), which represents the illustration of the key concepts of Culture, as well as the relationships that exist between these concepts. We believe that this model, presented in Savard, Bourdeau and Paquette (2010), can be used to compare and analyze different cultures. Using this model as a basis, we have created an upper ontology of Culture that we present in Section 4 of this paper.

2.2 Conceptual Model of Culture

In our procedural view, as shown in Figure 1 and explained in Savard, Bourdeau and Paquette (2010), Culture, as a cognitive structure composed of schemes, serves as an input to the process of interpretation, which allows us to build our mental representations of the world or of our environment (i.e., allows us to learn). These mental representations are then used as input to the representation process by which we represent the world (usually in order to share our mental representations or interact with other individuals). The process of representation allows us to produce manifestations of Culture (that are observable). These may take the form of behavior or artifacts that we keep for ourselves or share. They are not part of the Culture at the granularity level (see definition in Table 1) considered, but they have a culturality (Pretceille-Abdallah, 1999), i.e., the property of what is cultural.

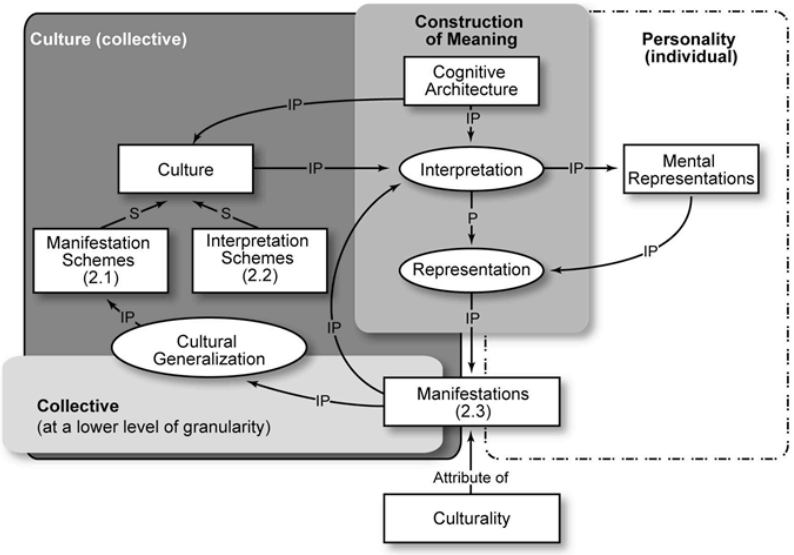

Figure 1. The Conceptual Model of Culture [1]

[1]Under the influence of these schemes that make up the Culture, the concrete manifestations can be reinterpreted and knowledge can be restructured and represented again. Over time and after a number of iterations, the manifestations will disappear or move to a higher level and become part of Culture via a cultural generalization process, at which point they serve as schemes for the lower levels.

We have represented cognitive architecture as an input to the process of interpretation, which precedes the representation process. According to Tooby and Cosmides (1992), all humans share a cognitive universal and highly organized architecture. This architecture consists of mechanisms that are rich in content and designed to meet the various "inputs" from local situations.

We consider the interpretation and representation processes to be at the heart of all teaching and learning activities. When we learn, we interpret and we represent. When we teach, we interpret and we represent. As we have explained, consciously or not (most often not), Culture influences the way we interpret and represent. That is how Culture can influence teaching and learning.

As explained in Mizoguchi (1998), the conceptual level of an ontology is a structured collection of terms. In Table 1, we have defined all the terms used in the conceptual model, which is at the basis of our work on the upper ontology of Culture that we present in Section 4 of this paper.

Table 1: Definitions of the Terms Used in the Conceptual Model of Culture

Term	Definition
Cognitive Structure	"Entity that represents the way in which properties of elements human cognition deals with are organised, with respect to each other, in terms of what is relevant for a task the individual performs." (Verhoef, 2007)
Evolving (cognitive) Structure	A structure which undergoes a slow gradual transformation in time and space, depending on the concrete manifestations.
Scheme	Abstract mental representation by which we anticipate the future, or by which we prepare action, either intellectual or physical. Scheme is considered as an element (in reference to the definition of Cognitive Structure).
Manifestation Scheme	Abstract mental representation of a physical reality (of a behavior or of an artifact) that guides the representation and interpretation processes. The manifestation scheme is used to create a manifestation (physical reality), and that manifestation can in turn become a manifestation scheme (and part of Culture) via a generalization process.
Behavior Scheme	Abstract mental representation reflecting and anticipating our own actions and those performed by others or those that can be attributed to others.
Artifact Scheme	Abstract mental representation of an object transformed, even minimally, by a human.
Interpretation Scheme	Abstract mental representation, most of the time unconscious, that guides, often automatically, our reading of the world, our learning, our understanding, our evaluation and the way we make sense of a manifestation. It functions like a truism.
Truism	Knowledge that is widely shared and rarely questioned.

[1] Figure 1 was designed using the software Mot+. The rectangles represent concepts and the ovals, processes. The "i/p" links represent inputs or products, the "p" links indicate precedence and the "s" links may be read as "subset of".

Values	Values are central constructs that function like truisms and that are supported by emotional information (inspired by Maio and Olson, 1998). They are relatively stable and durable. As pointed out by Schwartz (2012), when they are activated, they become infused with feeling, they refer to desirable goals that motivate action, they transcend specific actions and situations and they serve as standards or criteria. They are considered here as an interpretation scheme that orient our interpretations and representations of the world.
Interpretation (process)	Process that allows us to learn, to understand, to make our a physical representation, a manifestation.
Representation (process)	Process that allows us to make concrete the content of our thoughts, to share our mental representations, our knowledge.
Mental Representation (product)	Representations whose main characteristic is to exist or operate in the absence of a stimulus or an external situation.
Cognitive Architecture	Universal architecture composed of highly organized mechanisms that are rich in content and designed to meet the "inputs" of local situations.
Manifestation (concrete)	Physical reality, which may take the form of behavior or artifacts. These events are the product of the representation process and they have a culturality.
Cultural	That which is related to Culture.
Culturality	Property of that which is cultural.
Generalization	Operation by which a manifestation is adopted as a manifestation scheme through multiple uses of the manifestation as a reference by a majority of the members of a cultural group.
Granularity Level	The scale concerned by the Culture or used for an analysis or comparison, for example, universal, continental, national, provincial, local, etc.

3. Declarative and Procedural Approach to Culture

We have been introducing the procedural approach, but, in fact, two different approaches can be used to model Culture. Blanchard and Mizoguchi (2014) have adopted a declarative approach to represent the cultural domain. We have adopted a procedural approach to model Culture because it is process-oriented, it takes into account the evolving nature of Culture and we consider that it provides an essential basis for concrete and procedural solutions for cultural adaptation in ITSs. Table 2 presents a comparison between these two approaches.

Table 2: Two Different Approaches to Model Culture

Approach	Declarative	Procedural
Characterization	The objectives: 1) To concentrate and structure in one place the many scientific-grade notions needed to get a coherent view of the cultural domain. 2) Translate these scientific-grade notions into a common ground.	The objectives: 1) To represent how Culture can affect daily life, but more particularly teaching and learning. 2) Model the functionalities of Culture (process oriented).
What It Can Offer to the ITS Community	Guidelines to situate the cultural adaptation efforts into theory. Theoretical guidance to develop "theory-grounded Culturally Adapted Tutoring Systems (CATS)."	A framework for the analysis and comparison of cultures in order to facilitate cultural adaptation. A solid structure on which we can build different knowledge bases about cultural variables in different identified cultures.

4. Towards an Upper Ontology of Culture

On the basis of the Conceptual Model of Culture (Savard, Bourdeau and Paquette, 2010) and of the work at the conceptual level, we have developed an upper ontology of Culture, shown partly in Figure 2, where we clearly see that Culture is presented as being a cognitive structure composed of interpretation and manifestation schemes.

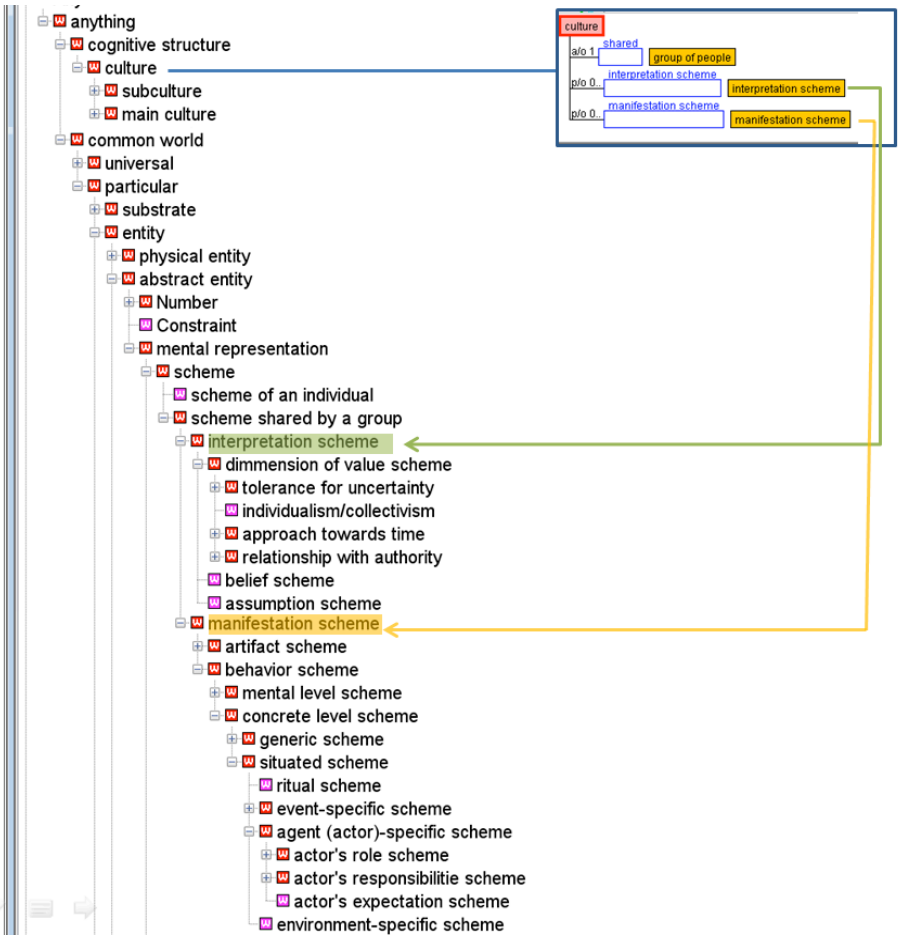

Figure 2. An Upper Ontology of Culture

We have defined a common world, inspired by the one we find in Omnibus, the ontology of education presented by Hayashi, Bourdeau and Mizoguchi (2009). In this world we have represented the interpretation and manifestation schemes according to the conceptual model and definitions introduced in Section 2 of this article. We have identified two different levels of behavior schemes: the mental and the concrete level schemes. In the latter, we distinguished between generic and situated schemes. We identified different kinds of situated schemes: ritual scheme, event-specific scheme, actor-specific scheme and environment-specific scheme. Using this structure, we can represent different specialized worlds, for example the educational world, and their associated subcultures. In each subculture we can identify cultural variables in the interpretation and manifestation schemes. Savard, Bourdeau and Paquette (2013) have identified cultural variables in the professional Culture of instructional design. Their work has inspired our work on the upper ontology, which we want to render capable of accommodating the identified variables.

5. Identified Cultural Variables in the Professional Culture of Instructional Design

Savard, Bourdeau and Paquette (2013) have grouped the identified variables into three main categories: values (interpretation scheme), human interactions and common practices (both manifestation schemes). The (dimensions of) Values category consists of the following variables: relationship with authority, tolerance for uncertainty, individualism/collectivism, approach towards time (represented in Figure 2). The Common Practices category consists of the following variables: learning aims, lesson plan, rhythm of learning activities, learning situations, pedagogical communication, instructional methods, cooperation-collaboration, detailed feedback, summative evaluation methods, results interpretation. The Human Interactions category consists of the following: teacher's role, learner's role, responsibility for reaching learning goals, responsibility for making available learning resources (all in

"actor-specific scheme" in the ontology presented in Figure 2). They have built an ontology of cultural variables (in instructional design).

In fact, we are currently working on a new version of the cultural variables (in the professional Culture of instructional design) ontology. This work is being completed in alternation with our work on the upper ontology of Culture presented in this article. Our goal is to build a strong basis for the development of tools that will support cultural adaptation in practice. We believe that these tools (upper ontology of Culture and revised ontology of cultural variables in instructional design) would help instructional designers, learners and teachers in their cultural adaptation. We believe that this may improve the effectiveness of international learning and teaching activities in both physical and virtual environments.

6. **Future Work**

We believe we have elaborated the basis for the development of a computerized system that we have the intention to develop. It could advise the instructional designer, the teacher and also the learner by using the knowledge modeled about theories of Culture (MAUOC, Blanchard and Mizoguchi, 2014), theories of education (OMNIBUS, Hayachi, Bourdeau and Mizoguchi, 2009) and the cultural variables identified in pedagogical practices (Savard, 2014). This system could take the form of a web module that would provide a framework for planning the learner's pedagogical path, for example in accordance with the philosophy of personal pedagogies (Maina and Garcia, 2016). The user (Instructional Designer, Teacher or Learner) could find information and/or advice both on cultural adaptation and variables and on strategic pedagogical practices based on theories of education. The prototype of this system will be tested and will allow us to stabilize our ontologies.

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